A HISTORY OF THE MARCONI COMPANY. *By W. J. Baker. New York, St. Martin's Press. Pp. 414. $12.95.*

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This history of the Marconi Company is written by one of the firm's technical editors. Its organization and contents reflect his belief that what really counted was inventiveness, loyal engineers, and good leadership (with a strong assist from two world wars). W. J. Baker states in his preface that the book is "not a product of Company sponsorship," but he has clearly enjoyed during its preparation full access to the company archives and to the personal recollections of many of its engineers and executives. The result is a volume which is, within its limits, both authoritative and fascinating.

It is also frustrating and provoking. The business historian will be dissatisfied with the book's skimpy treatment of the internal organization

and finances of the Marconi enterprises. The economic historian of more general interests will complain of the author's reluctance to compare and generalize. The focus is quite sharply on the British and Imperial activities of the company, and too little is said of parallel and competitive developments in Germany and the United States. The historian of technology will, I imagine, be most content with the book. The author's technical expertise and knowledge are impressive, and the insights he gives us into the mind of a major inventor and the operations of a firm which devoted itself to technological innovation are very valuable. Still there is little systematic analysis, and if the author's approach satisfies historians of technology, the reason is probably that they themselves are not yet clear about what are the right questions to ask.

As for myself, I found the first third of the book thoroughly rewarding, dealing as it does with those phases of the story closest to my own research interests: Marconi's early experiments; the extent of his scientific knowledge and of his links with the scientific community; the family background that provided him with his initial financing and entrée into British officialdom (modern electronics owes much to Jameson's Irish whisky!); and the early ventures into long-distance wireless telegraphy that made his name a household word. The author, to his credit, records and indeed seems to echo the skepticism that much surround the conventional story of Marconi's first trans-Atlantic reception of radio signals in Newfoundland in 1901, but he also sets that episode in proper perspective. What Marconi needed at that juncture was a technical success that would yield publicity (Edison and de Forest in the United States, and later Baird in England, were no less adept at using the press as an entrepreneurial resource). When Marconi and his one assistant heard — through the crashes of static and via a receiver with no amplification whatsoever — "the unmistakable rhythm of three clicks," they heard what they desperately wanted to hear. No one who knew Marconi ever accussed him of dishonesty, but he was as capable of self-deception as any of us. It would have been better if he had not specified beforehand what code letter the Poldhu station should transmit.

As might be expected, the book excels in the presentation of technical innovations. Circuit diagrams, for those able to read them, clarify many points that might remain obscure if expressed in the King's English. This is particularly true in regard to questions of priority in invention and (a less obvious point) our understanding of precisely what it was that was invented. Only in summarizing more recent developments does the author slip into chronicles of technicalities. Perhaps for some readers it is important to know that in 1932 the company's research engineers were working on "polarization effects in a graded medium, magnetoionic effects, reflection coefficients, reciprocity, phase integrals, refraction theory, upper atmosphere ionization and recombination and other matters" (291), but for most of us it would probably suffice to be told that an intense (and belated) study of the Kennelly-Heaviside layer was under way. I found only a few places where I believe the author fails to grasp the full significance of the technical advances he describes. The description of the Slaby-Arco receiving antenna (33) — important for the later competitive rise of the Telefunken system — suggests that

Slaby had as early as 1900 been able to conceptualize an antenna as a resonant circuit. Otherwise, why specify that the vertical and horizontal sections should each equal a quarter-wave at the operating frequency? Marconi and his assistants did not, I believe, make this conceptual advance until some time later. Along the same lines, while I fully agree with Baker and others on the basic importance of Marconi's "four sevens" tuning patent of 1900, I am not sure that at that time they had fully grasped the importance of selective tuning for transmission as contrasted with reception. Tuning was thought of as a way of minimizing interference at the receiver between competing spark transmitting stations, each radiating signals "as broad as a barn door." It was not thought of as a means of spectrum conservation, nor as a means of concentrating a transmitter's effective radiated power.

Why worry about these technical details? I think there are good reasons. In the first place, they were important in a business sense for inter-corporate maneuvering. And secondly, they may help us form a better model of how invention and innovation happen. Lack of such a model, even in embryonic form, is one of the major limitations of this book and leads the author into labelling as "ironies" what might, in a more adequate frame of reference, seem quite intelligible. For example, longer wavelengths and higher power meant longer ranges — so at least it was believed by Marconi and all his contemporaries. Shorter wavelengths and higher frequencies meant no more than line-of-sight transmission. This belief was fallacious, reflecting a lag in scientific knowledge which Marconi engineers were eventually to help remedy. But precisely because of this lag we find Marconi and his competitors straining their resources to build their gigantic spark and alternator transmitters, running over thirty kilowatts in power and tuned to wavelengths as high as 6,000 meters, to achieve distances that any modern amateur on the twenty-meter band can achieve with 150 watts and a home-made "peanut whistle." The difference lies not in better components or circuits, but in better knowledge of the ionosphere. Marconi's inventions in radio were certainly based on science — the science of Faraday, Clark Maxwell, Hertz, and Oliver Lodge. But the attempt to use these inventions to compete with the transatlantic cable carried him into a realm where science at the time had little to say. The result was a reversion to the technological clichés of the nineteenth century: giantism and higher power. The great spark stations at Poldhu, Glace Bay, Clifden, and Wellfleet, the Poulson arcs and the Alexanderson alternators — these monsters were echoes of a technology on the way out as much as they were harbingers of the technology of the future.

But there is true irony in the story, nevertheless, particularly in the thought of Marconi at the close of his career, turning once again to the centimeter wavelengths — the ultra-high frequency end of the spectrum that Hertz had been exploring a half-century before and that was, before another fifty years had passed, to bring us radar and space communications. Had it all been a technological detour? Might long-distance radio communication, if Marconi had not intervened, have developed in quite a different way, with lower power, smaller and more directional antennas, much higher frequencies, and more exploration of the ionosphere? Or

are these detours the trips technology takes while it waits for science to catch up?